As a result of the congestion on the backbone networks, users complain that they do not see the benefit of faster connections using ISDN or cable modems.[52] An FCC working paper concluded that, "[h]igher-bandwidth access to the Internet will be meaningless if backbone networks cannot provide sufficient end-to-end transmission speeds."[53] Residential users cannot be expected to spend more for Internet access until they can be assured that the product they are buying is fast and reliable. Until stable backbones with adequate bandwidth are built, consumer adoption of ADSL and ISDN, and of competing technologies like cable modems – which increase transmission speed and bandwidth at the local level -- will be delayed.[54]

This shortage of bandwidth will continue to plague Internet users for the foreseeable future. Upstarts such as Qwest, IXC Communications, Williams, and Level 3 Communications (headed by former MFS CEO James Crowe) are building networks with an additional 63,000

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[52] This "means that performance of next-generation technology such as cable-TV or satellite modems will be severely limited, at least until overall Internet throughput for standard Web content is substantially improved." *Id.* "[Y]ou have to wonder exactly what these cable modem boosters are about. While it's possible for a cable modem to get the home Web page from the local cable modem server at some blazing speed, this is simply misleading if the average time of all the backbones is 50 kbps. 50 kbps is the average speed you will get, period! [Similarly,] 128K ISDN . . . isn't that useful." J. Dvorak, *Slower Than You Think,* PC Magazine Online, Aug. 11, 1997 (discussing the previous Keynote study, which showed a top Internet speed of about 50 kbps). *See also* R. Gareiss, *Mapping a High-Speed Strategy*, Data Communications, Apr. 1997, at 62 ("Increasing the speed of the local loop won't work miracles with sluggish Internet access, since factors like server speed and congestion at Internet NAPs . . . affect actual throughput."); D. Hoye, *The Access Is Easy*, Arizona Republic, Oct. 13, 1997, at E1 ("I've found that roaming the Internet with souped-up access doesn't guarantee great results.")

[53] K. Werbach, Office of Plans and Policy, FCC, OPP Working Paper 29, *Digital Tornado: The Internet and Telecommunications Policy* at 54 (Mar. 1997).

[54] See Keynote Press Release, *First Independent Ranking of Internet Backbones Rates CompuServe Tops in Performance*, June 25, 1997, http://www.keynote.com/company/announcements/pr062597.html ("increasing bandwidth to the home or office beyond ISDN speeds will probably not improve the Web experience for end users until backbone connectivity improves dramatically. . . . With most of the backbones, the current crop of new 56 Kbps modems pretty much gives you what you're going to get . . . . This information is going to wreck a lot of business plans because, when the word gets out that increasing bandwidth won't do much for you, customers will opt for the cheaper dial-up route even after higher speeds are available.").

miles of fiber over the next two years.[55] But according to the Wall Street Journal, "demand [for bandwidth] is far outstripping supply. . . . Mr. Crowe and his partners are betting that the trend will continue for decades."[56]

In addition to general congestion problems, the Internet is often plagued by outages, as three incidents this past summer on UUNet's network illustrate. On June 16, memory problems with UUNet's routers in Illinois, New Jersey, New York, and Washington, D.C. slowed Internet traffic throughout the Northeast corridor.[57] Two weeks later, UUNet frame relay switches began sending incorrect information to each other, periodically cutting off service entirely to some businesses and ISPs.[58] On July 17, railroad engineers using a backhoe dug into a WorldCom fiber route, cutting 533 high-speed Internet circuits. Although ISPs and the backbones were able to re-route traffic in several hours, traffic going into New York and much of the Northeast remained slow for most of the day.[59] One UUNet customer remarked that UUNet's "quality of

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[55] J. Keller, *Ex-MFS Managers Plan to Build Global Network Based on Internet*, Wall St. J. Interactive Edition, Jan. 20, 1998, http://interactive.wsj.com/archive/retrieve.cgi?id=SB885239070258306000.djm&template=pasted-1998-01-20.tmpl.

[56] *Id.* Industry analysts agree that demand for bandwidth will continue to outstrip supply. *See* J. Rendleman, *ISP Service Shift: Sprint's Rate Hike for T-3 Net Access Signals the End of IT Bargain Shopping*, PC Week, Jan. 5, 1998, at 1 (quoting Rick Eisener, vice president of sales and marketing at InterNex Information Services: "price trends in the [Internet bandwidth] marketplace are going up and not down. At the moment, demand is outstripping supply, and that means prices are going up."); D. Rohde, *Right Out of the Gate, an MCI Price Hike*, Network World, Nov. 17, 1997, at 10 (quoting Rick Malone, president of Vertical Systems Group: "Demand for bandwidth far exceeds supply right now."); D. Radcliff, *Traffic Jam*, Software Magazine, Nov. 1997, at 98 (quoting Mike Rothman, vice president of global network strategies at the Meta Group: "There's a lot of money thrown into making sure the Internet scales up. But I think demand will always outstrip supply."); *Size Matters: ISPs Highlight Survival Recipes*, Internet Week, Oct. 13, 1997 (quoting Alan Taffel, UUNet vice president for marketing and business development: "If you are not a facility-based ISP you will very soon find there is no more capacity out there to lease, and if you find some, you will be paying premium on it while competing with ISPs that own their own networks.").

[57] R. Barrett, et al., *UUNet Struggles to Keep Network Operating*, Interactive Week, July 7, 1997.

[58] *Id.*

[59] R. Barrett, *Net Survives A Bad Week*, Interactive Week Online, July 18, 1997. The fiber cut was the third in as many weeks for WorldCom. *See* M. Williams, *Another Fiber Cut as InterNIC Admits to Domain Name Snafu*, Newsbytes, July 18, 1997 and R. Deger, *Net Snafus a Real Hoedown*, ZDNet News, July 17, 1997 (detailing fiber

service has gone down dramatically in the last two years."[60] Similar problems have plagued the Internet for the past year and longer.[61]

Problems in any one part of the network often affect performance nationwide. For example, the July WorldCom fiber cut forced a rerouting of traffic through other areas, causing congestion and delays for all Northeast traffic. The Keynote/Boardwatch backbone study noted that "Internet brownouts," such as those caused by fiber cuts and other backbone outages, "produce measurable performance degradation for all users."[62]

The NAPs are also a source of congestion. Any traffic running through MAE East is choked by mediocre bandwidth, according to one observer.[63] On July 11, 1997, the MAE West NAP lost power between 7 and 11 a.m., delaying 80 percent of all U.S. Internet traffic, and completely cutting off any ISPs solely interconnected at MAE West.[64] As MCI has stated, "The NAPs are the bottlenecks."[65]

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cuts in major Los Angeles-Las Vegas and New York-Washington, D.C. routes).

[60] R. Barrett, et al., *UUNet Struggles to Keep Network Operating*, Interactive Week, July 7, 1997 (quoting Joe Shaw, network administrator at Insync Internet Services, a Houston ISP).

[61] In the fall of 1996, an outage by MCI's backbone left most of Minnesota without access for more than 12 hours. J. Gaw, *Reliability Check*, Minneapolis Star Tribune, Sept. 18, 1996, at 1D. In November 1996, AT&T WorldNet service "lost" 200,000 subscribers' e-mail for a day due to a router failure. C. Lu, *Make Room For Data*, Inc., Mar. 18, 1997, at 33. A similar failure at the Microsoft Network delayed delivery of 1 million messages in April 1997, almost one year after the network suffered a failure that completely shut it down for ten hours. S. LaPolla, *Internet Outages Strain Corporate Messaging*, PC Week, Apr. 21, 1997, at 1; B. Klien, *Are Power Outages a Fact of Life For Online Marketing?*, Business Marketing, Nov. 1, 1996, at M8.

[62] Keynote Systems, *Top 10 Discoveries About the Internet*, http://www.keynote.com/measures/top10.html.

[63] J. Dvorak, *Breaking Up the Internet Logjam*, PC Magazine, Apr. 8, 1997, at 87; *see also* R. Gareiss, *Is the Internet in Trouble?*, Data Communications, Sept. 21, 1997, at 36 ("even the stack of switches at MAE East can't keep up with peak load, which can hit 1 Gbit/s.").

[64] P. Lambert, *West Coast Net Exchange Point Hit By Power Outage, Causes Web Slowdown*, Interactive Week, July 11, 1997; M. Williams, *Power Failure Knocks Out Major West Coast Internet Link*, Newsbytes, July 14, 1997. Outages on MAE East and MAE West have been numerous. MAE West went down for another hour the morning of July 16, 1997. R. Barrett, *Net Survives A Bad Week*, Interactive Week Online, July 18, 1997. In January 1997, MAE East crashed for 12 hours, forcing UUNet to divert all traffic across the country to MAE West. K.

Servers. All Internet service ends, as it begins, on a computer. Some of these computers are operated by ordinary "users," some by ISPs like AOL, CompuServe, and Microsoft, others by dedicated Web content providers like HotWired and Salon, still others by traditional commercial enterprises like banks and airline companies. About 19 million servers provide Internet content and services today.[66] Some servers have plenty of capacity to meet demand; others do not. The speed of Internet service can thus be choked by the computer at the far end, just as it can be choked by a modem at the near end or the backbone in the middle. One analyst notes that, since "most servers today operate at 56 kbps," higher-bandwidth access technologies like xDSL that receive at speeds much faster than that are not very useful until the problems of backbone and server congestion are solved.[67]

Server-induced congestion occurs quite often, especially when sites turn out to be more popular than their designers anticipated. In July 1994, NASA's Jet Propulsion Laboratory web site had trouble accommodating the enormous public interest in pictures of the Shoemaker-Levy 9 Comet slamming into Jupiter.[68] Similarly, when NASA's Sojourner began transmitting images from the surface of Mars, NASA reported that its multiple Internet sites recorded more than 40

Gerwig, *The Lowdown on Internet Breakdowns,* NetGuide, Apr. 1, 1997. MAE West's primary and back routers failed simultaneously in June 1996; the resulting outage lasted several days. *News Briefs,* Network World, June 3, 1996, at 6.

[65] S. Alexander, *Traffic Jams Becoming Way of Life on Internet*, Minneapolis Star Tribune, Jan. 18, 1997 at 1A (quoting MCI).

[66] Network Wizards, *Internet Domain Name Survey*, July 1997, http://www.nw.com/zone/WWW/report.html.

[67] *See* K. Maxwell, Independent Editions, *Cable Modems and ADSL,* http://www.adsl.com/adsl_vs._cable.html. *See also Fast Downloads*, PC Magazine, Nov. 18, 1997, at 83 ("slow and overloaded servers remain slow and overloaded, regardless of your connection speed.").

[68] In the week after the collision, the JPL site logged 100,000 hits, or more than 1,000 an hour, compared to 12,000 hits the entire week before the collision. J. Byczkowski, *On-line Sky Gazers Crowd the Internet*, Cincinnati Enquirer, July 24, 1994 at F10.

million hits in one night, with some sites remaining clogged for hours.[69] Microsoft's web site, www.microsoft.com, gets 88 million hits per day, and access to it is often slow.[70] The average speed of the entire Internet fell sharply the week Microsoft released the new version of its web browser, Internet Explorer 4.0, due to heavy download traffic.[71]

Some server failures disrupt service all the way back down the network. The local Internet access provided by large ISPs like AOL, CompuServe, and MSN depends on access to databases maintained by those same companies in their national servers. In April 1997, after Microsoft suffered its second server outage in six weeks due to overuse of the systems, it took down all nine of its servers while it added nine more. The resulting outage prevented users from sending and receiving e-mail for 36 hours.[72] When America Online suffered a 19-hour shutdown in 1996,[73] AOL's subscribers lost access not only to AOL's own content, but to all the rest of the Internet too.

III. The Decline of Competition in the Provision of Backbone Services

As of November 1997, some 34 North American providers operated Internet backbone networks of one kind or another in the United States.[74] These providers include four

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[69] A. Sweeney, *Earthlings Dialing Up the Party Line to Mars*, Chicago Tribune, July 6, 1997, at C1.

[70] N. Leach, *Microsoft.com's Poor Performance Frustrates Users*, PC Week, June 30, 1997, at 1.

[71] J. Pelline, *Net Jams Hinder Faster Connections*, CNET News.com, Oct. 22, 1997, http://www.news.com/News/Item/0,4,15539,00.html?nd (citing Keynote/Boardwatch backbone study).

[72] S. LaPolla, *Internet Outages Strain Corporate Messaging*, PC Week, Apr. 21, 1997, at 1; C. Cooper, *Users in Dark as MSN Goes on Crash Course to Fix E-mail Problems*, ZDNet News, Apr. 17, 1997.

[73] B. Klein, *Are Power Outages a Fact of Life For Online Marketing?*, Business Marketing, Nov. 1, 1996, at M8.

[74] J. Rickard, *Measuring the Internet*, Boardwatch Magazine Directory of Internet Service Providers, July/Aug. 1997, at 20.

interexchange carriers, America Online, CompuServe, IBM, and major ISPs (PSINet, BBN Planet, owned by GTE). There is, however, much less competition in the backbone market than meets the eye. And the current trend is toward a tight oligopoly – or worse. Through a combination of factors, completion of its deal with AOL, CompuServe, and MCI will leave WorldCom as by far the dominant provider of Internet backbone services. **Table 1.**

Backbone "Peers." To begin with, not all backbones are equal. The major backbones and ISPs traditionally operated on "peering" arrangements, under which they accepted and handed off traffic to each other at no charge. In May 1997, WorldCom/UUNet broke ranks and began charging smaller ISPs and backbone networks for interconnection; only ISPs that can "route traffic on a bilateral and equitable basis" to and from WorldCom are given free interconnection.[75] Several of the smaller backbones complained,[76] but quickly capitulated. MCI, BBN, and Sprint then began charging smaller backbones too.[77]

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[75] R. Barrett, *UUNet Sets Official Peering Requirements*, Interactive Week Online, May 13, 1997, http://www.zdnet.com/zdnn/content/inwo/0513/inwo0001.html.

[76] NetRail, a backbone headquartered in Atlanta, called WorldCom's decision to stop peering "a restriction of free trade." J. Poole, *Midrange ISP Prices Climb; UUNet, Sprint End Free Traffic Services,* InfoWorld, May 5, 1997, at 10. GeoNet Communications, a backbone headquartered in Redwood City, California, suggested that "ISPs might band together to maintain peering." T. Abate & J. Swartz, *Internet Fee Feud Heats Up Over a Firing,* S.F. Chron., May 6, 1997, at C1. CAIS Internet stated, "we disagree with UUNet's new peering position and believe it may be anti-competitive." CAIS Press Release, *CAIS Internet Responds to New UUNet Peering Policy*, PR Newswire, May 1. *See also UUNet Technologies To Cut Off Free Connections To Its Internet Backbone*, Business Wire, Apr. 25, 1997 ("The move is seen as a power play designed to force smaller providers to pay for access – or possibly go out of business.").

[77] B. Riggs, *Free Ride Is Over for Small ISPs*, LAN Times, May 26, 1997, at 19.

Table 1. Market Power in Internet Backbone Industry

National providers	Peers (pre-WorldCom deals)	Peers (post-WorldCom deals)	NAP owners	Global backbone
AGIS	America Online	AT&T	Sprint	**WorldCom/UUNet/ AOL/MCI**
America Online	AT&T	BBN	**WorldCom/UUNet/ AOL/MCI**	
AT&T	BBN	CWIX		
BBN	CWIX	IBM		
CAIS	IBM	PSINet		
CompuServe	MCI	Sprint		
Concentric Network	PSINet	**WorldCom/UUNet/ AOL/MCI**		
CRL	Sprint			
CWIX	**WorldCom/UUNet**			
DataXchange				
Digex				
Electric Lightwave				
Epoch				
Genuity				
GeoNet				
GetNet				
GlobalCenter				
GoodNet				
GridNet				
IBM				
IDT				
Inet				
MCI				
Nap.Net				
Net Access				
NetCom				
Priori				
PSINet				
Savvis				
Sprint				
TCG CERFnet				
VisiNet				
Vnet				
WorldCom/UUNet				
ZipLink				

The upshot, today, is that within the community of backbones exists an elite, self-selected group of "peers" – nine, at present.[78] The penalty to an ISP not granted peering from the other backbones is severe: the non-peers must pay up to several hundred thousand dollars per month in interconnection charges from one of the providers, and must discontinue peering with the other backbones.[79] WorldCom/UUNet, for example, will not allow any provider that purchases interconnection from it to interconnect freely with any other backbone. From an economic perspective, one obviously cannot lump together as competing "providers" two groups of players when one group supplies a service for a fee, and the other pays for it. The group of nine, the self-defined peers, are the suppliers of the true Internet backbone today. The rest are, in varying degrees and ways, their customers.

Consolidation Among Backbone Providers. The number of backbone peers has declined radically in the past year due to various mergers and acquisitions. In September 1997, the national backbones began to consolidate, with WorldCom, the owner of UUNet, one of the largest backbone providers, purchasing the AOL and CompuServe backbones.[80] By purchasing AOL, WorldCom/UUNet reduced the number of peers from nine to eight. WorldCom appears to have emerged victorious in a bidding war for MCI, reducing the number of peers to seven and

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[78] J. Kornblum, *Will WorldCom Own the Backbone Business?*, CNET News.com, http://www.news.com/News/Item/0,4,14171,00.html (citing Nathan Stratton, CEO of NetRail). The nine include WorldCom/UUNet, MCI, Sprint, AT&T, PSINet, America Online, Cable & Wireless, IBM, and BBN. *See also GTE's MCI Bid Impacts AT&T's Net Position*, Internet Week, Oct. 20, 1997 (defining seven peers using slightly different definition). According to WorldCom/UUNet, the amount of traffic passing between it and the non-peering backbones is insignificant. P. Lambert, *UUNet Fees Threaten to Break Up Internet*, Interactive Week, Apr. 30, 1997, http://www.zdnet.com/zdnn/content/inwk/0413/inwk0024.html (citing Alan Taffel, UUNet marketing vice president).

[79] P. Lambert, *UUNet Fees Threaten to Break Up Internet*, Interactive Week, Apr. 30, 1997.

[80] S. Lohr, *AOL to CompuServe's Customers in 3-Way Deal*, N.Y. Times, Sept. 8, 1997, http://www.nytimes.com/library/cyber/week/090897compuserve.html.

acquiring the number one Internet backbone for $37 billion as part of the second-largest merger ever.[81] More recently, peers have begun snapping up other backbones. In November, GTE, which purchased BBN this summer, acquired Genuity, a smaller backbone.[82] On January 8, AT&T announced it was purchasing Teleport Communications Group, owner of the TCG CERFnet backbone.[83]

Traffic Shares. The WorldCom/MCI merger will create a dominant player in the Internet backbone market, judged by the percentage of Internet traffic carried on their networks.

WorldCom's combination of UUNet with AOL's ANS backbone, the CompuServe backbone, and MCI's backbone will give WorldCom a commanding share of the total backbone traffic and capacity. Most industry analysts estimate MCI/WorldCom will carry about 60 percent of Internet traffic.[84] Pre-merger UUNet alone claimed to carry "35 percent to 40 percent of U.S. data traffic on the Net."[85] WorldCom/UUNet has also boasted that, after its "acquisition of CompuServe and its agreement to carry America Online's traffic, about 50 percent of the U.S.

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[81] *MCI Accepts New WorldCom Bid, MSNBC*, Nov. 10, 1997, http://www.msnbc.com/news/122668.asp.

[82] S. Revah, *GTE Internetworking to Acquire Genuity*, CNET News.com, Nov. 13, 1997, http://www.news.com/News/Item/0,4,16367,00.html.

[83] *AT&T to Merge with Teleport*, CNET News.com, Jan. 8, 1998, http://www.news.com/News/Item/0,4,17952,00.html.

[84] *See* E. Narvaes, *Rooting for WorldCom-MCI Merger*, Denver Post, Oct. 8, 1997, at C1 (citing Decision Resources analyst); B. Meeks, *Justice Probes WorldCom-MCI Deal*, MSNBC, Oct. 15, 1997, http://www.msnbc.com/news/114540.asp; J. Aversa, *MCI Shareholders Must Choose Between Two Suitors*, Associated Press, Oct. 7, 1997; T. Weber and R. Quick, *Would WorldCom-MCI Deal Lift Tolls on Net?*, Wall St. J., Oct. 2, 1997, at B1.

[85] *Internet Order Bolsters Ascend*, San Francisco Examiner, Apr. 25, 1997, at B-1; *see also* D. Bowermaster, *WorldCom Bulks Up*, MSNBC, Sept. 15, 1997, http://www.msnbc.com/news/108831.asp ("WorldCom Inc. already sports the busiest Internet network of any company on the planet."); *UUNet Technologies To Cut Off Free Connections To Its Internet Backbone*, Business Wire, Apr. 25, 1997 (UUNet is "one of the four largest providers of backbone service").

dial-up traffic will be on the UUNet network.[86] MCI has asserted that its backbone carries over 40 percent of Internet traffic.[87] One analyst estimates that five backbone networks (MCI, Sprint, UUNet, BBN, and AOL) "handle 80 percent of the nation's Internet traffic."[88]

The traffic share estimates thus vary widely. But by every current estimate, combining the Internet backbones of UUNet, AOL, CompuServe, and MCI will leave WorldCom in a commanding position. WorldCom will own the top two backbones, a third in the top five, and CompuServe's as well. Further, WorldCom will combine several of the best performing backbones. According to the most recent Boardwatch study of Internet backbone performance, the CompuServe, UUNet, and MCI backbones rank third, fourth, and fifth, respectively, out of 34 North American backbones; America Online's ranked ninth.[89]

Control of Critical Network Access Points. The backbone providers connect their networks at 11 major "network access points" (NAPs).[90] MFS, another subsidiary of WorldCom, owns four of these. But like the backbones themselves, all NAPs are not equal. According to one analyst, WorldCom's MAE East in Washington, D.C. handles more than 60 percent of all

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[86] K. Gerwig, *UUNet Plants Multicast Flag*, Internet Week, Sept. 29, 1997.

[87] Bert C. Roberts, Chairman & CEO, MCI, remarks before National Press Club luncheon, Oct. 29, 1996; *see also* G. Gilder, *Telecosm Feasting on the Giant Peach*, Forbes, Aug. 26, 1996, at 84 (MCI carries 40 percent over Internet traffic). UUNet has boasted of being bigger than MCI. *See* B. Meeks, *Justice Probes WorldCom-MCI Deal*, MSNBC, Oct. 15, 1997, http://www.msnbc.com/news/114314.asp.

[88] S. Lohr, *Internet Growth Brings Up Questions of Governance*, N.Y. Times, May 12, 1997 (citing Gordon Cook, publisher of the Cook Report).

[89] Keynote Systems and Boardwatch Magazine, Keynote/Boardwatch Internet Backbone Index, Nov. 11, 1997, http://www.keynote.com/measures/backbones/backbones.html.

[90] J. Rickard, *Internet Architecture*, Boardwatch Magazine Directory of Internet Service Providers, July/Aug. 1997, at 8-9. These interconnection points: four official Network Access Points (NAPs) in San Francisco, Chicago, Washington, D.C., and Pennsauken, N.J.; four Metropolitan Area Exchanges (MAEs) operated by MFS in Washington, D.C., San Jose, Ca., Los Angeles, and Chicago; two Federal Internet Exchanges (FIXes) in Mountain View, Ca. and College Park, Md.; and a Commercial Interexchange (CIX) in Santa Clara, Ca. Backbones are also linked at hundreds of other interconnection points wherever more than one backbone has a router or POP in the

worldwide traffic and an estimated 85 percent of all intra-European traffic.[91] By another account, MAE East handles roughly 40 percent of U.S. Internet traffic.[92] The disruption caused by an outage in MAE East or MAE West is quite severe; when MAE West suffered a four hour outage in June, up to 80 percent of all Internet traffic was affected.

As owner of four of the NAPs, WorldCom has the ability to influence the terms by which traffic is shared not only between its network and other networks, but among other networks as well. An ISP cut off from the WorldCom NAPs is in dire straits; the other NAPs are overwhelmed with traffic and incredibly congested.[93] Ownership of these facilities gives WorldCom influence in the marketplace above and beyond that given it due to the size of its fiber network. No other backbone can claim this sort of control; only one other backbone, Sprint, is in direct control of even a single NAP (the Pennsauken, N.J. "official" NAP).

Control of Complementary Backbone Networks Outside the United States. A final function of backbone providers in the United States is to supply links to backbones in other countries. There are at least 35 million Internet users outside the United States, and probably many more.[94] In some ways, this worldwide market is just another network, another peer, with which WorldCom/UUNet must interconnect to provide full access to its customers.

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same room.

[91] J. Dvorak, *Breaking Up the Internet Logjam*, PC Magazine, Apr. 8, 1997, at 87.

[92] P. Merrion, *What a Tangled Web Users Weave,* Crain's Chicago Business, Dec. 9, 1996.

[93] *See* Section II; *see also* R. Gareiss, *Is the Internet in Trouble?*, Data Communications, Sept. 21, 1997, at 36.

[94] This is a conservative estimate; it assumes there was no growth in non-U.S. Internet subscribership in 1997. The International Telecommunications Union estimated there were 60 million Internet users worldwide at the end of 1996. ITU Press Release, *New ITU Report Tracks Internet Growth and Development*, Sept. 7, 1997, http://www.itu.ch/PPI/press/releases/1997/itu-15.html. Other analysts were estimating about 25 million U.S. Internet users at that same time.

Here too, WorldCom/UUNet has already moved far ahead of its backbone competitors, as it owns the largest global Internet backbone as well. The company operates extensive European and Asian backbone networks of its own. WorldCom/UUNet's pan-European Internet backbone links hubs in ten European cities, with links directly to Asia and North America. WorldCom/UUNet boasts that its "Two Trans-Atlantic DS-3s and several multi-megabit routes mean WorldCom/UUNet can deliver more pure Internet connectivity to Europe and Asia than any other provider."[95] WorldCom's MAE East NAP routes the bulk of all intra-European traffic.[96] CompuServe has also significantly improved its European bandwidth and upgraded its trans-Atlantic backbone.[97] MCI likewise has a large and busy global backbone, serving over 60 countries.[98]

In several countries, WorldCom/UUNet is a major ISP in its own right, in addition to being a backbone provider. WorldCom/UUNet has aggressively purchased national ISPs and integrated them into its worldwide network: since 1995, WorldCom/UUNet has purchased major ISPs in England, Belgium, Luxembourg, Germany, and The Netherlands.[99] WorldCom/UUNet

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[95] UUNet, *UUNet High Performance Network*, http://www.uu.net/lang.en/network/europe.shtml (1997).

[96] J. Dvorak, *Breaking Up the Internet Logjam*, PC Magazine, Apr. 8, 1997, at 87.

[97] CompuServe Press Release, *CompuServe Scales European IP Capabilities, Forges US Internet Peering Points*, Apr. 29, 1996.

[98] *See* J. Rickard, *National Backbone Operators*, Boardwatch Magazine Directory of Internet Service Providers, July/Aug. 1997, at 156; MCI, *Internet Service*, http://www.mci.com/aboutyou/interests/technology/internet/service.html.

[99] UUNet UK, *Company Profile*, citing the Durlacher Quarterly Internet Report, http://www.uk.uu.net/company/; UUNet Press Release, *UUNet PIPEX Takes Controlling Stake In Belgium's Largest ISP*, Aug. 9, 1996; UUNet Press Release, *INnet NV Completes Integration Process with UUNet*, Apr. 29, 1997; *UUNet Acquires Leading German Internet Service Provider 11/27/96*, Newsbytes, Nov. 27, 1996; *WorldCom's UUNet Buys Dutch NLnet - Plans to Dominate European Internet Services by 1999*, Computergram International, Sept. 5, 1997.

says it is on course to become the leading Internet player in every European market within the next two years.[100]

None of the other major backbone providers have the same European presence as WorldCom/UUNet. AT&T and Sprint, for example, have trans-Atlantic backbones in place, but not of the same size and capacity as UUNet's. Nor do they possess the same degree of in-country facilities as WorldCom, especially as augmented by the MCI, CompuServe, AOL, and European ISP purchases. Cable & Wireless, by contrast, has extensive European facilities, but does not own trans-Atlantic facilities, likely making it dependent on UUNet and the MAE East NAP.

Network Scope and Market Power. WorldCom, with the combined UUNet, AOL, CompuServe, and MCI backbones, will be even more dominant than conventional measures of market share suggest. The Internet's value depends in large part on the total number of people and the quantity and quality of the content connected to it, due to "network externalities."[101] "Metcalfe's Law of the Telecosm," named for Robert Metcalfe, the inventor of Ethernet, declares that the value of a network increases as the square of the number of nodes – users and servers – connected to the network.[102] Assuming conservatively that the combined WorldCom networks provide service to 50 percent of Internet nodes, then 75 percent or more of Internet traffic will

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[100] *WorldCom's UUNet Buys Dutch NLnet - Plans to Dominate European Internet Services by 1999,* Computergram International, Sept. 5, 1997.

[101] *See, e.g.*, J. M. Stevens, *Antitrust Law and Open Access to the Internet*, 38 Vill. L. Rev. 571 (1993).

[102] *See* B. Metcalfe, *Metcalfe's Law: A Network Becomes More Valuable as It Reaches More Users*, Infoworld, Oct. 2, 1995; G. Gilder, *Metcalfe's Law and Legacy*, Forbes ASAP, Sept. 13, 1993; Reed Hundt, Chairman, FCC, speech before Wall Street Journal Business and Technology Conference, Washington, D.C., Sept. 18, 1996 (Metcalfe's Law is one of the "best foundation[s] for understanding the Internet.").

cross one of WorldCom's networks at some point in a transmission.[103] At 60 percent of nodes, 84 percent or more of Internet traffic will have to move at some point through WorldCom's facilities. By contrast, if we assume that the next largest backbone, say AT&T, connects only 20 percent of nodes, then the percentage of Internet traffic carried exclusively over its own network is 4 percent. WorldCom's network is thus vastly more valuable to the other providers than their networks are to WorldCom. Roughly speaking, WorldCom's market power will increase more as the square (or a higher power) of its "market share." With four backbones and half the NAPs under its control, industry analysts have anointed WorldCom "the King of the Internet."[104] Overall, one observer remarked that WorldCom now has "more bandwidth than God."[105]

WorldCom's peering policy – the standards by which it judges whom it will charge for interconnection, and with whom it will exchange traffic for free – may provide it the proper lever to exploit its new network scope. In May, WorldCom/UUNet said it would continue to peer only with ISPs that can "route traffic on a bilateral and equitable basis."[106] John Sidgmore explained that, "A few years ago, all ISPs were generally the same size and used each other's infrastructures to a more or less equal extent. Today that situation no longer exists, and consequently there are

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[103] Assuming that, on average, each node generates an equal amount of traffic, a 50 percent share of nodes means that 50 percent of traffic will originate on one of WorldCom's networks. Likewise, half of the 50 percent of traffic that originated elsewhere – 25 percent of total traffic – will terminate with WorldCom, for a total percentage carried by WorldCom of 75 percent.

[104] A. Bary, *The Trader,* Barron's Online, Sept. 15, 1997; *see also* J. Sandberg, *How One Company Is Quietly Buying Up the Internet,* Wall St. J., Sept. 9, 1997, at B1 ("acquisitions have turned WorldCom into an Internet giant").

[105] K. Gerwig, *WorldCom: More Bandwidth than God*, Internet Week, Sept. 15, 1997 (quoting Dwight Gibbs, Chief Technology Officer of The Motley Fool web-based investment site).

[106] Randy Barrett, *UUNet Sets Official Peering Requirements*, Interactive Week Online, May 13, 1997, at http://www.zdnet.com/zdnn/content/inwo/0513/inwo0001.html.

many cases where peering is not appropriate."[107] It announced it would only exchange traffic freely with its largest competitors, who were of roughly the same size and scope.

Even that situation is no longer true. MCI WorldCom will have no peers. No backbones will be "generally the same size," nor will they "use each other's infrastructure to a more or less equal extent;" no carrier will be able to "route traffic on a bilateral and equitable basis" with WorldCom. If WorldCom enforces its prior interconnection standards, even AT&T and Sprint can expect WorldCom to stop freely peering with its networks.[108]

IV. Advanced Internet Service "To All Americans"

The national objective set out in Section 706 is to extend an advanced network not just to business customers, or urban users, but "to all Americans."[109] That objective, however, is plainly not shared by the small group of companies now in control of the Internet backbone.

Of the 34 backbones, only a handful offer residential service at all. Only one (AT&T) has a significant number of residential customers and a primarily residential focus, and even that focus is beginning to fade. All the dominant backbone providers do of course interconnect (for a fee) with smaller ISPs that serve residential customers. But the backbone operators have made it clear that they will engineer their networks, and extend their highest-bandwidth capabilities, in accordance with their own competitive priorities. Those priorities are centered entirely on urban business markets.

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[107] *Id.*

[108] The ISP Consortium, a group of ISPs based in Atlanta, has already expressed concerns that a combined WorldCom-MCI could drive up Internet prices for ISPs. M. Thyfault, *Users Assess WorldCom's $30 Billion Bid for MCI*, InformationWeek, Oct. 6, 1997.

WorldCom has made cherry-picking lucrative business customers the centerpiece of its competitive strategy.

In local markets, WorldCom is focused almost exclusively on business customers. WorldCom has a "[b]usiness customer focus," and a "focus on major U.S. and international cities."[110] The networks operated by its local arm, MFS, like the local networks WorldCom proposes to acquire (those of Brooks Fiber and MCI) are almost exclusively urban, and are threaded exclusively through business, not residential areas.[111] "Our strategy is not in the consumer business," the company flatly declares. "It's very difficult for us to find a way to make economic sense out of the advertising budgets, the customer service budgets, etc., required to be in the consumer business."[112] According to Chairman and CEO Bernard Ebbers, "Not AT&T, not MFS or anyone else, is going to build local telephone facilities to residential customers. Nobody ever will, in my opinion."[113]

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[109] Telecommunications Act of 1996 § 706(a).

[110] S. Comfort, et al., Morgan Stanley, Dean Witter, Co. Rpt. No. 2556537, WorldCom Inc. 15 (June 3, 1997).

[111] MFS has constructed 52 fiber networks to serve businesses in major markets, and plans to purchase fiber networks in 40 other markets as part of its Brooks Fiber and MCI acquisitions. WorldCom Press Release, *WorldCom and Brooks Fiber Announce Merger*, PR Newswire, Oct. 1, 1997.

[112] M. Mills, *WorldCom Would Shift MCI's Focus*, Wash. Post, Oct. 3, 1997, at A1 (quoting John Sidgmore); G.W. Woodlief, et al., Prudential Securities Inc., Co. Rpt. No. 2539124, WorldCom Inc. 1 (Mar. 10, 1997). *See also* K. Russell, *Ebbers: WorldCom, Mississippi Paired for the Future*, Mississippi Business Journal, May 12, 1997, at 13 (quoting Bernard Ebbers: "[O]ur focus is primarily on business customers."); T. J. Mullaney, *Competition Calling: Anyone There?*, Baltimore Sun, Apr. 6, 1997, at 1D (quoting Ron Vidal, WorldCom vice president for new ventures, "We don't play in residential."); D. Lyons, *Internet Service Providers – Revenue Booms, But Strain On Profits Prompts New Emphasis On Value-Added Services*, Computer Reseller News, June 2, 1997 (quoting John Sidgmore, "From the very start, we've been focused on the business market rather than the consumer market, and I think that has really set us apart.").

[113] M. Mills, *Hanging Up on Competition?*, Wash. Post, June 1, 1997, at H1.

WorldCom's voice long-distance business is likewise focused largely on business customers. Only 5 percent of WorldCom's revenues come directly from residential end users.[114] WorldCom and MCI combined would serve some 27 million presubscribed long-distance lines (about a 17 percent share) and earn about $20 billion in long-distance revenues (a roughly 25 percent share).[115] Soon after the proposed acquisition of MCI was announced, one senior WorldCom official candidly suggested that WorldCom would be happy to shed MCI's 20 million residential long-distance customers as soon as the merger was completed.[116] WorldCom plans to compete aggressively for business customers, however, offering bundles of local, long-distance, and Internet service to customers.[117]

WorldCom's current Internet arm, UUNet, likewise ignores residential markets completely. UUNet provides Internet services directly only to businesses and other ISPs; it connects to residential customers only indirectly, through the (disproportionately large) ISPs it serves.[118]

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[114] T.K. Horan, et al., Smith Barney, Co. Rpt. No. 1826935, WorldCom Inc., at Table 4 (Jan. 7, 1997). The company earns 20 percent of its revenues from residential customers, but only indirectly, by selling network capacity wholesale to resellers like Excel Communications. S. Comfort, et al., Morgan Stanley, Dean Witter, Co. Rpt. No. 2556537, WorldCom Inc. 9 (June 3, 1997).

[115] FCC, Long Distance Market Shares, Third Quarter 1997 at Tables 2.2, 3.2 (Jan. 1998).

[116] M. Mills, *WorldCom Would Shift MCI's Focus*, Wash. Post, Oct. 3, 1997, at A1. A day later, Sidgmore clarified his remarks, denying he would abandon MCI's residential customers but noting that "Our religious focus is on the business customer. It is a jihad." M. Mills, *WorldCom Clarifies MCI Plans*, Wash. Post, Oct. 4, 1997, at D1.

[117] According to one analyst, WorldCom "envisions turning its $600 per month long distance customer into an estimated $1,500 combined local ($300 per month), long distance, and Internet ($600 monthly) customer." G.W. Woodlief, et al., Prudential Securities Inc., Co. Rpt. No. 2539124, WorldCom Inc. 2 (Mar. 10, 1997).

[118] *See* 1996 WorldCom Annual Report 28 (1997) (UUNet is the world's largest provider of Internet access services to "businesses, professionals and on-line services providers.").

WorldCom's proposed acquisitions fit perfectly with this business-only strategy. MCI serves only a small percentage of residential Internet customers.[119] By acquiring the AOL and CompuServe networks, and not the companies themselves, WorldCom purchases a huge amount of bandwidth, but leaves the large base of residential and small business customers, and the future care and acquisition of these customers, to AOL. AOL and CompuServe have become merely WorldCom's largest two corporate customers.

The other peering backbone providers are similarly business-oriented.[120] GTE's BBN, for example, plans to "focus solely on providing Internet services and solutions to businesses and organizations."[121] IBM boasts over 30,000 commercial accounts around the world, but not a single residential subscriber.[122] Cable & Wireless's CWIX subsidiary markets its services only to other ISPs.[123] Sprint has attracted less than 100,000 Internet subscribers in the past year, limiting its marketing only to low-churn, high-revenue customers.[124] PSINet has over 170,000 consumer accounts, but has stopped marketing to non-business customers and has been selling its residential accounts to other ISPs since 1996.[125] Only AT&T and MCI have subscriber bases

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[119] *EarthLink Pins Growth on Two-Fold Strategy Key Elements Involve Referral, Acquisition Programs*, Internet Week, July 14, 1997.

[120] *See* K. Gerwig, *ISP Challenge: Breaking Away From the Crowd*, Internet Week, Oct. 6, 1997 (describing trend among ISPs to abandon non-commercial customers).

[121] BBN Corporation, 1996 Annual Report: Letter to Shareholders (1997).

[122] J. Rickard, *National Backbone Operators*, Boardwatch Magazine Directory of Internet Service Providers, July/Aug. 1997, at 73.

[123] *Id.*

[124] *Sprint Has Dual Strategy*, Internet Week, June 9, 1997.

[125] J. Rickard, *National Backbone Operators*, Boardwatch Magazine Directory of Internet Service Providers, July/Aug. 1997, at 73.

large enough to rank among the top ten ISPs, and AT&T alone has shown any serious interest in providing Internet services to residential customers.[126]

Backbone providers can, of course, provide advanced, high-speed, reliable service without being actively engaged themselves in retail sales to either business or residential users. But when backbone operators are actively engaged in retail service to urban business users alone, residential and rural users are certain to lose.

The basic architecture of these backbones illustrates how marketing priorities have driven engineering priorities. National backbones connect a dozen or so high-speed nodes over T-3 (45 Mbps) or faster (up to 612 Mbps) trunks. Virtually all of these primary nodes have been placed in large cities, especially the largest 30.[127] Thus, the highest-capacity direct connections all run between large city pairs, in much the same way as jumbo jets connect New York and Los Angeles, but fly over North Dakota, West Virginia, and South Carolina. The backbone operators have extended their high-speed backbones to only a few other areas outside of city centers: Silicon Valley, Cambridge, Ma., greater Los Angeles, Chicago, the Washington Beltway, and suburban New Jersey.[128]

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[126] AT&T had about 900,000 AT&T WorldNet subscribers signed up by the middle of 1997. J. Rickard, *National Backbone Operators*, Boardwatch Magazine Directory of Internet Service Providers, July/Aug. 1997, at 61. In October 1997, however, AT&T announced the launch of its own, "high-performing" Internet backbone, for business customers only, featuring interconnection agreements to all the NAPs, peering arrangements with 40 major providers, direct network connections to major ISPs, private peering agreements with PSINet and IBM, and 99.5 percent reliability guarantees. AT&T Press Release, *AT&T Announces Business-Quality IP Services*, Oct. 8, 1997. No such service has been announced for residential customers.

[127] For example, half or more of the U.S. backbones have major nodes in Boston (16 backbone connections), San Jose (16), Houston (17), San Francisco (18), Dallas (19), New York (22), Los Angeles (22), Atlanta (21), Chicago (25), and Washington, D.C. (26). Only two cities outside of the top 30, Orlando and Austin, are served by even five backbones. J. Rickard, *National Backbone Operators*, Boardwatch Magazine Directory of Internet Service Providers, July/Aug. 1997, at 51-208 (hub cities); Rand McNally, 1993 Commercial Atlas & Marketing Guide 60 (1993) (market size).

[128] J. Rickard, *National Backbone Operators*, Boardwatch Magazine Directory of Internet Service

Other cities, towns, and rural communities connect to the backbones over whatever capacity trunks the backbone operators and/or regional ISPs choose to run in their general direction – typically T-1 or 56 kbps lines.[129] It is entirely a matter of provider discretion. A few smaller communities must still connect to the Internet by placing toll calls over the voice network. The operators of the backbone networks, WorldCom most particularly, have little interest in communities like these. Their incentive is to continue funneling new backbone investment toward the urban, business customers they also serve at retail.

Incumbent backbone operators also lack the resources to extend high-speed backbones to residential areas. The backbones are spending hundreds of millions of dollars per year trying in vain to keep even their major city-to-city links up to par. For example, WorldCom/UUNet is spending $300 million in 1997 to upgrade its existing network from T-3 (45 Mbps) to OC-12 (622 Mbps).[130] But expanding the network outside of the top 30 cities is a vastly more difficult and expensive task. Connecting Washington, D.C. to New York, San Jose, and Los Angeles is expensive, but not overly so – the distances are long but the number of routes few. Further connecting Washington (and New York, and San Jose, and Los Angeles) to even nearby smaller communities (say, Wilmington, Charleston, Front Royal, Harrisburg, and so on) with high-speed lines becomes very costly very quickly as the number of routes increases, even as the distances shorten.

Providers, July/Aug. 1997, at 73.

[129] *Id.*

[130] *Size Matters*, Internet Week, Oct. 13, 1997. MCI spent $60 million upgrading its network in 1996, Sprint $100 million in 1995 and 1996. T. Mulligan, *The Cutting Edge*, L.A. Times, Feb. 3, 1997, at D1. The other major backbones are also pouring capital into their networks. *Id.*

Today's Internet thus offers much less uniformity in access and service quality than the voice network. Local phone companies of course engineer their switches and networks to accommodate customer densities and traffic volumes. But all the while, the voice networks are engineered to offer residential consumers and rural users reliability and "blocking" probabilities as good or better than those delivered to business subscribers and urban communities.

V. Local Phone Companies and the Objectives of Section 706

When they were spun off from AT&T in 1984, the Regional Bell Companies inherited switches that were still almost entirely analog or, even worse, electromechanical. Today, nearly 90 percent are digital.[131] Bell Atlantic's switching today is almost 94 percent digital.[132] During this same period, the Bell Companies have also fully deployed SS7,[133] an advanced digital signaling network that rapidly speeds call setup and supports advanced features. By 1996, SS7 was operational for 93 percent of RBOCs' access lines.[134] Bell Atlantic has SS7 capability in at least 94 percent of its lines.[135] Bell Atlantic has also deployed packet-switching capabilities in nearly 40 percent of its end offices.[136] **Figure 9**.

Local telephone companies, with Bell Atlantic a leader among them, thus have an excellent record of investing aggressively in new telecom technologies and infrastructure – a far

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[131] FCC, Trends in Telephone Service at Table 12 (Mar. 1997).

[132] *Id.* at Table 13.

[133] Bell Atlantic proprietary information, citing FCC 43-07 Annual Report filed June 28, 1996 with updates through July 25, 1996.

[134] FCC, Trends in Telephone Service at Table 13 (Mar. 1997).

[135] Bell Atlantic information, citing FCC 43-07 Annual Report filed June 28, 1996 with updates through July 25, 1996.

better record than any other segment of the industry. In raw dollar terms, Bell Companies spent roughly $18 billion on capital improvements in 1996,[137] with Bell Atlantic and NYNEX accounting for $4.5 billion of this total. Bell Companies are currently spending hundreds of millions a year just to accommodate growing use of on-line services;[138] Bell Atlantic alone spent $200 million to that end in 1996, and spent $300 million more in 1997.[139]

No other segment of the telecommunications industry has made any remotely comparable commitment to upgrading local Internet infrastructure. Cable companies invested $6.9 billion on capital improvements in 1996, less than half as much as Bell Companies.[140] Wireless companies spent $8.5 billion.[141] The three largest local competitors – WorldCom/MFS, TCG, and Brooks Fiber, invested only $1.2 billion,[142] and that figure includes spending on long distance networks. **Figure 10.**

High levels of capital spending have allowed Bell Companies to deploy fiber-optic cable aggressively. By 1997, the new Bell Atlantic had deployed over 3.8 million fiber miles in its region – more than all interexchange carriers combined have in their nationwide networks, three

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[136] Bellcore, TR-EOP-00315, Local Exchange Routing Guide (LERG), Dec. 1, 1997.

[137] 1996 Annual Reports of Bell Atlantic, SBC, Pacific Telesis, NYNEX, BellSouth, U S West, and Ameritech.

[138] J. Marshall, *Economics, Not Engineering, Will Unclog Internet*, S.F. Chron., Nov. 4, 1996, at E1.

[139] This total represents Bell Atlantic's "emergency investment in expanded facilities just to serve the increased Internet traffic." Joint Comments of Bell Atlantic and NYNEX on Notice of Inquiry at ii, 6, Access Charge Reform, CC Dkt. No. 96-262 (F.C.C. filed Mar. 24, 1997).

[140] R. L. Katz, et al., Bear Stearns & Co., Inc., Co. Rpt. No. 2554013, Cablevision Systems 32 (May 21, 1997) (Cablevision investment); R. L. Katz, et al., Bear Stearns & Co., Co. Rpt. No. 1875639, Time Warner 91-92 (Mar. 27, 1997) (Time Warner, Comcast, Cox, and TCI investment).

[141] *See CTIA Pegs 12-Month Wireless Capital Investments at More Than $10 Billion*, Wireless Today, Oct. 24, 1997.

[142] 1996 Annual Reports of WorldCom, TCG, and Brooks Fiber.

times as much as all competitive access providers combined, and more than the entire cable industry has deployed nationwide.[143] **Figures 11 and 12.** Over 11 percent of Bell Atlantic's network is now fiber.[144] The deployment of these fiber networks has allowed local phone companies to meet rapidly rising demand for bandwidth from both business and residential subscribers. Local phone companies supplied some 14 million second lines to residential subscribers in 1995, about one-third of which are used for on-line access.[145] The prevalence of this fiber will also enable Bell Atlantic to provide high-speed access to its smaller markets, which the incumbent backbones are both unwilling to do and unable to afford.

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[143] FCC, Fiber Deployment Update, End of Year 1996 at Tables 2, 6 and 14 (Aug. 1997).

[144] *Id.* at Table 12.

[145] FCC, Trends in Telephone Service at Table 19 (Mar. 1997); Joint Comments of Bell Atlantic and NYNEX on Notice of Inquiry at 11, Access Charge Reform, CC Dkt. No. 96-262 (F.C.C. filed Mar. 24, 1997).

Figure 9: Bell Atlantic Deployment Digital Switching and SS7

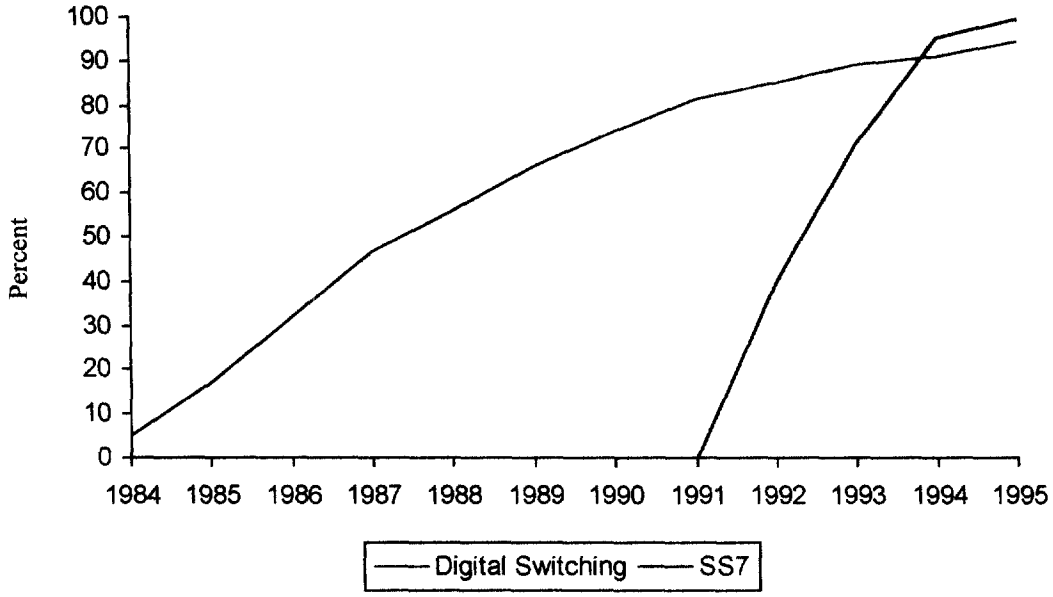

Figure 10: Capital Expenditures By Industry Group

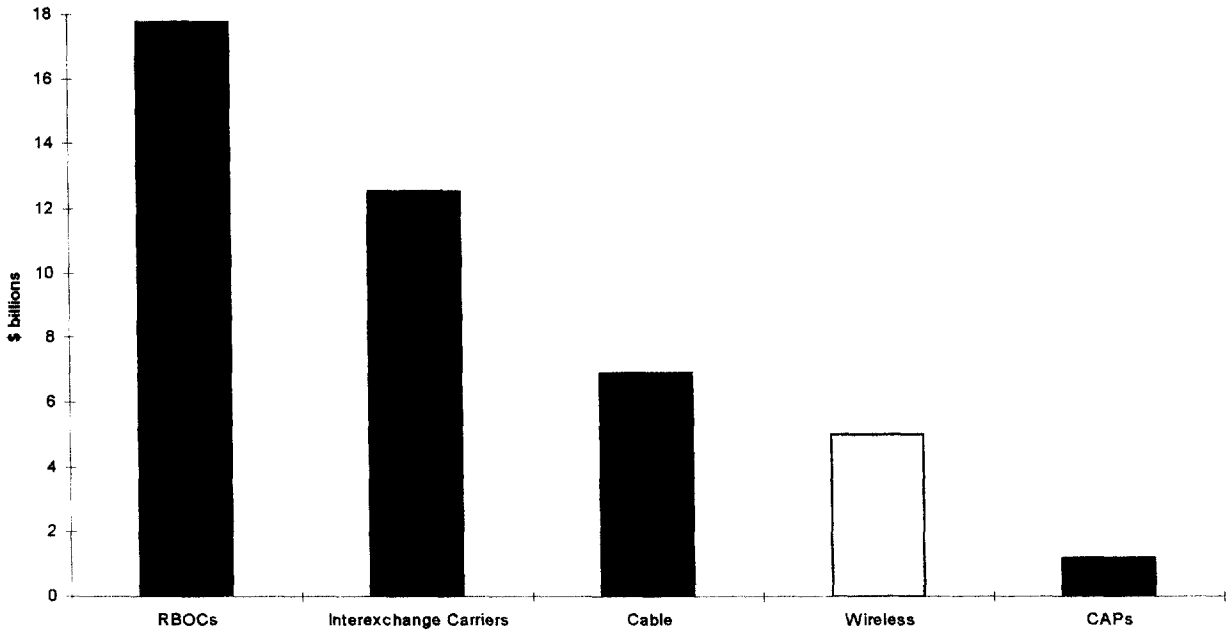

Figure 11: Bell Atlantic Fiber Deployment 1986-1997

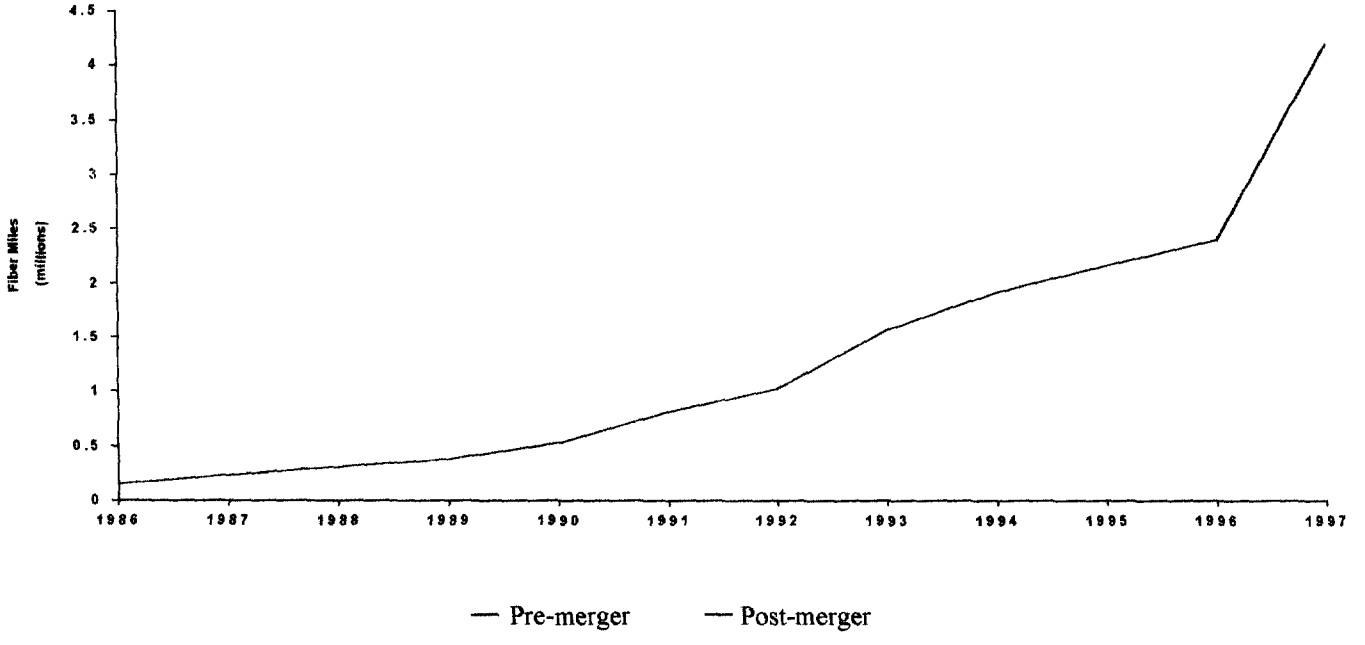

Figure 12: Fiber Deployment By Industry Group (1996)